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North Korea's Lead in Artillery Poses a Challenge for the South

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An Intelligence Assessment

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EA 83-10018C

February 1983

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This paper was prepared by Northeast Asia Division, Office of East Asian Analysis. 25X1

contributed to its preparation. 25X1

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The paper was coordinated with the National Intelligence Council. 25X1

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North Korea's Lead in Artillery Poses a Challenge for the South

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Key Judgments

Information available as of 20 January 1983 was used in this report.

The primary battle in a war on the Korean Peninsula would be fought on the ground, where North Korea has its most substantial edge in combat potential over the forces of the South. Two of the most important elements to measure in assessing the capabilities of armies are firepower and maneuverability. Firepower is particularly important in Korea where the terrain limits maneuvers on a broad scale.

Despite a sustained effort by South Korea to reduce the North's edge in firepower by adding artillery, a comparison of the inventories on both sides shows that the South has fallen further behind in most measures of artillery capability:

- North Korea now has nearly two and a half times as many artillery weapons. When measures of capability—aggregate weapons effectiveness—are applied to the artillery weapons in both forces, the North's edge is identical to its numerical lead.

- North Korea has nearly one and a half times as many light and medium guns and howitzers. The South leads in heavy weapons, but neither side has many. In addition, North Korea has a significant numerical advantage in multiple rocket launchers, which can deliver large amounts of ordnance very rapidly.

- The North has a substantial edge in salvo weight—a measure of the amount of explosives that all artillery pieces could fire at one time.

- The North's weapons have a much better firing range than those of South Korea.

- Mobility favors the North; its large numbers of self-propelled weapons have several advantages over the towed guns that predominate in the South.

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South Korea has certain qualitative advantages in artillery:

- Many of its guns have better accuracy, and it has more effective munitions.
- The South's doctrine and tactics would allow it to use artillery with more flexibility and efficiency.

Nonetheless, an examination of the artillery weapons included in a scenario depicting an all-out North Korean attack against the South shows that the North's advantages in the initial stages of conflict are markedly similar to those found when comparing weapons inventories. In this scenario the South's artillery is substantially outnumbered and outranged.

The North's advantages are reduced when airpower is brought into the artillery equation, because South Korea's Air Force is superior to that of the North. For example, the North's lead in explosives delivery shrinks markedly when the bombs that the aircraft on both sides could deliver are included in a comparison of salvo weight. The aircraft of both Koreas, however, are limited by poor weather and darkness—factors that have far less effect on the performance of artillery. The South's Air Force also would be taxed heavily by the demand to perform multiple roles in combat—antiair, antiarmor, and antiartillery. (See appendix A for a summary of the impact of airpower).

South Korea plans to add more modern artillery weapons and may reduce substantially the North's lead in range over the next four years. North Korea's edge in other factors is not likely to change, however, and the South will remain at an overall disadvantage in artillery. It appears that South Korea will remain committed to airpower to counter the North's advantage in artillery, as well as to make up for shortcomings in armor and infantry.

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Contents

	Page
Key Judgments	iii
Comparing the Artillery Forces	1
Weapons Inventories	1
Comparison by Weapons Caliber	2
Explosives Delivery	2
Range	4
Mobility	4
Supply and Production	4
Mortars	6
Factors Favoring the South	6
Ammunition	6
Accuracy and Elevation	6
Doctrine and Tactics	7
Defensive Advantage	7
Artillery in an Attack Scenario	9

25X1

Appendixes

UNCODED A.	The Impact of Airpower on the Artillery Equation	13

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North Korea's Lead in Artillery Poses a Challenge for the South [1]

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Comparing the Artillery Forces

Both Koreas have been expanding and improving their artillery forces at a substantial rate since the 1970s. North Korea had a head start, however, with a larger force in being and a domestic production capability already established. In 1975, the South launched its first Force Improvement Plan, which was designed to reduce the North's edge in combat capability. Improvements in artillery were a major part of the plan; North Korea was estimated to then have a lead in numbers of artillery weapons of about 2 to 1.

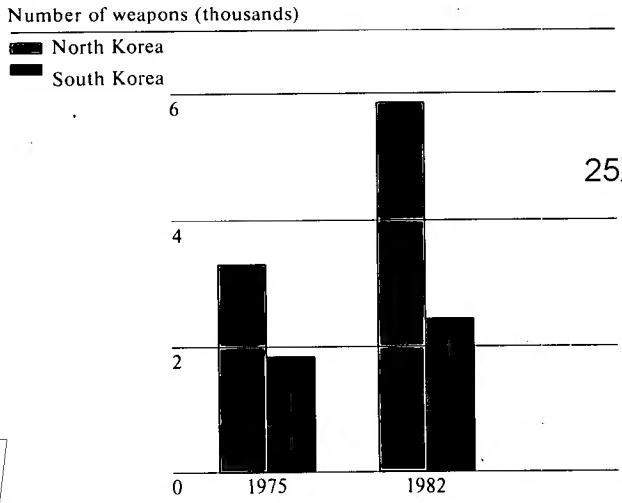
Eight years of Force Improvement Plans increased the South's inventory of artillery by over 30 percent, but the gap widened because North Korea accelerated its own production of artillery (see figure 1). By the end of 1982, the North had raised its artillery force level by 77 percent.[2]

Weapons Inventories. North Korea now has the fourth-largest artillery force in the world. Although it lags far behind the Soviet Union and China it has three-fourths as many artillery weapons as the United States. More important, North Korea has a lead of 2.4 to 1 over the South in numbers and in weapons quality as measured by aggregate weapons effectiveness: [3]

	North	South
Total weapons [a]	**5,847**	**2,426**
Guns and howitzers	4,074	2,408
Multiple rocket launchers	1,773	18
Aggregate weapons effectiveness	**482,314**	**197,998**

[a] Inventory numbers reflect only those weapons in active military units. (See appendix B for a more detailed description of the inventories of the two sides)

Figure 1
Comparison of Korean Artillery Weapons by Number



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In the key characteristics that make up WEV, the North's artillery ranks high in range, in rate of fire, and in mobility; the South's in accuracy and reliability.

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[3] Aggregate weapons effectiveness is a method used to compare the capabilities of the equipment of opposing forces through the use of numeric values. It is determined by summing the weapons effectiveness indexes (WEI) for all weapons in a class—artillery in this case—and multiplying this total by a weighting factor for a particular class of weapons as used in offense or defense in the Northeast Asian theater of operations. The WEI are numeric values for each weapon—based largely on firepower, mobility, and survivability—as compared to a standard weapon in its class.

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A good portion of the North's numerical edge comes from its large number of multiple rocket launchers (MRLs). Nearly half of them are towed weapons with short range and a relatively low level of destructive power. The rest are truck-mounted weapons of larger caliber with long range.

In numbers of cannon, which are more effective than MRLs for many artillery missions, the North's lead is smaller—about 1.8 to 1. If the rather ineffective, small caliber 76-mm guns are removed from the comparison, the North's edge in gun tubes drops to 1.4 to 1. Still, the North has the numerical advantage in guns, and the large number of MRLs and light weapons add substantial firepower to the lead in cannon.

Comparison by Weapons Caliber. Comparing the artillery of the two Koreas by size of weapons can lead to arbitrary judgments that stress certain advantages over others that may be of equal or greater importance. Table 1 displays two different categorizations of artillery that show how North Korea's numerical edge is distributed by caliber. Category A was devised by the US Intelligence Community and groups the South's 105-mm cannon with the North's 122-mm howitzers because both serve as light artillery for infantry divisions.[4] This comparison also places the smaller 76-mm guns of the North in a lower category.

The alternative method shown in category B—that used by the US Army—illustrates a far higher lead for the North in numbers of medium weapons: almost 5 to 1.[5] It classes North Korea's 122-mm howitzers as medium-caliber weapons because these cannon have nearly one and a half times the shell weight and destructive power of the South's 105-mm howitzers. The 105-mm gun has similar advantages over the 76-mm gun. Both methods of classifying weapons by

[5] See Headquarters, Department of the Army, FM 6-20, 30 September 1977, *Fire Support in Combined Arms Operations*.

Table 1
Comparisons by Caliber

Weapons	North	South	Ratio
Category A			
Heavy (175 to 203 mm)	24	188	7.8 to 1, South
Medium (130 to 155 mm)	1,794	930	1.9 to 1, North
Light (105 to 122 mm)	3,447	1,308	2.6 to 1, North
Other (under 105 mm)	582	0	
Category B			
Heavy (161 to 210 mm)	24	188	7.8 to 1, South
Medium (122 to 160 mm)	4,368	930	4.7 to 1, North
Light (under 122 mm)	1,455	1,308	1.1 to 1, North

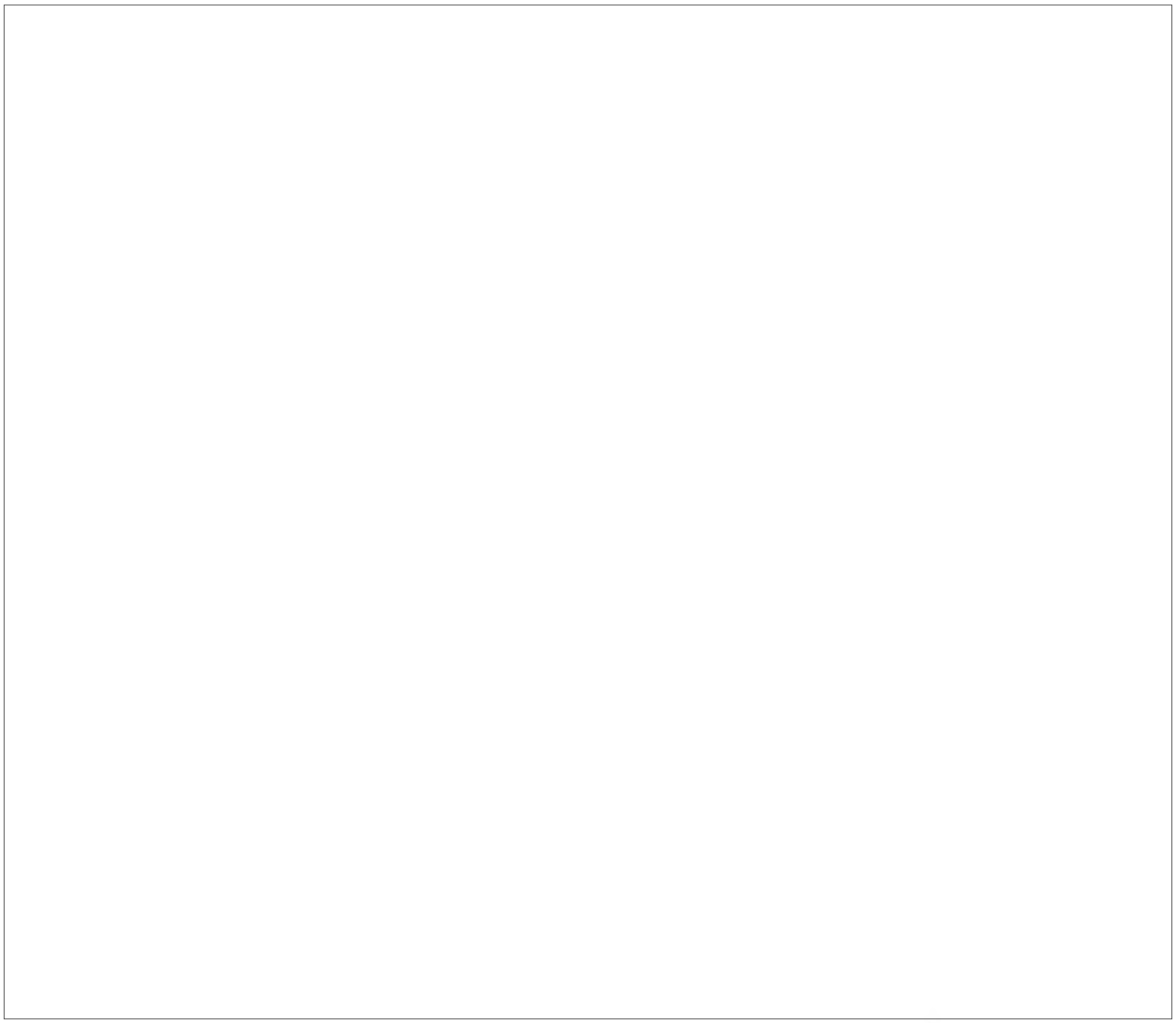
size include the rather ineffective 107-mm rocket launcher of the North in the same category as the South's 105-mm, which is generally regarded as one of the best light howitzers ever produced.

Both methods of comparison show that the majority of artillery on both sides fall into the light and medium categories and that North Korea has more than twice as many weapons in these classes as South Korea. The South's advantage in heavy guns is small in comparison to the total number of weapons.

Explosives Delivery. North Korea's artillery has a significant advantage in explosive delivery capability as measured by salvo weight:

	North	South	Ratio
Total weapons	**726,119 kg**	**86,400 kg**	**8.4 to 1, North**
Total gun tubes	**118,370 kg**	**75,600 kg**	**1.6 to 1, North**

Salvo weight is the combined weight of all projectiles fired by all weapons at one time. This is a simple measure that does not account for the capability for



sustained fire, but it provides an insight into where some of the important strengths lie in the different types of weapons in the two forces.

MRLs provide 80 percent of the North's capability to deliver explosives in terms of salvo weight. In many ways, however, MRLs compare unfavorably with guns and howitzers, especially in terms of accuracy. Nor can they be used effectively for sustained fire, because reload times are slow. Rocket launcher units usually carry only one reload, and resupply is hampered by the difficulties in transporting the large quantities of ammunition they use. The flash, smoke, and burn trails resulting from rocket firing make them highly visible targets.

In terms of cannon alone, the North's advantage in explosives delivery decreases markedly. The salvo weight for guns and howitzers favors the North by only about 1.5 to 1. Cannon can provide accurate and sustained fire. Shells are less subject to wind deflection than the finned rockets, and powder charges for

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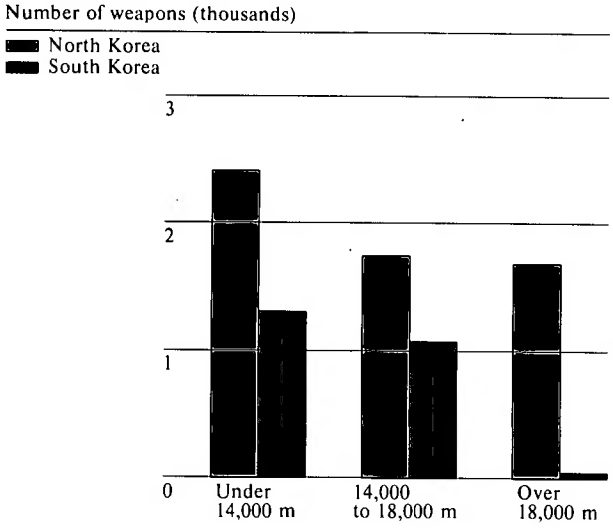
Figure 3
Comparison of Korean Artillery by Range



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accurate range can be determined with much more precision than the burn time of rocket motors. Cannon can be reloaded quickly.

Some missions can be better accomplished with MRLs than with cannon, however. MRLs can be devastating weapons against enemy firing batteries and fixed defensive lines because they can saturate an area with large amounts of explosives in a very short time. The standard truck-mounted MRL in the North's forces, the BM-11, can fire 30 rounds of 122-mm ammunition to 20,000 meters in less than 30 seconds.

Range. Perhaps the most critical disadvantage of the South in artillery is that of range. North Korea has almost 1,700 weapons that can fire at ranges in excess of 18,000 meters—more than 40 times the number that the South has (see figure 3). The most effective counterbattery weapon in Korea probably is the North's 130-mm field gun with its 27,000-meter maximum range. The only artillery piece in the South that can reach or exceed that range is the 175-mm gun. But South Korea has only 12 of these to counter the North's 350 130-mm guns. South Korea has only 30 other artillery weapons that can match the over 20,000-meter maximum ranges of the North's 900 BM-11 MRLs, and 280 122-mm field guns.

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The standard medium howitzers in the North also outrange those of the South. At maximum range, the 152-mm gun-howitzer of the North will outreach South Korea's M114 155-mm howitzer by almost 3 kilometers. The range advantage would allow many gun batteries in the North to fire on those in South Korea while remaining out of range of the South's artillery weapons.

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In the western sector, for example, South Korean artillery firing at maximum range from presently occupied positions would barely reach past the Demilitarized Zone—and only up to 5 kilometers into North Korea in the most favorable areas.

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In contrast, the North's 152-mm cannon and 122-mm rocket launchers firing at less than maximum range—15,000 meters—have sufficient distance to cover most South Korean artillery sites. The North's 122-mm and 130-mm field guns—firing at a range of only 20,000 meters—would be able to reach virtually all South Korean artillery positions.

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Mobility. North Korea has 12 times as many tracked weapons as the South (1,400 to 115). On offense, such highly mobile artillery is vital in providing continuous fire support for fast-moving mechanized forces.

Mobility is also directly related to survivability. The ability to fire and move quickly to another position before being located by the enemy is a valuable safety factor. Tracked weapons can fire, move, and set up to fire again 4 to 5 times faster than towed pieces. Neither the self-propelled guns made in North Korea nor those currently in use in the South have turrets to protect the crews, so safety depends on mobility.

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Supply and Production. We do not believe either side has critical shortages of artillery ammunition, but the North may have a considerably larger stockpile. Both

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Table 2
Numbers and Characteristics of Mortars

	Number of Weapons	Caliber *(mm)*	Range *(meters)*	Maximum Rate of Fire
North Korea	162	160	8,040	3 rounds per minute
	1,900	120	5,700	15 rounds per minute
South Korea	1,343	107	5,650	20 rounds per minute

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countries produce most of their own ammunition as well as their own weapons.

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The large number of different caliber weapons in the North's arsenal could, we believe, cause problems in resupply. In divisional artillery alone, the North must provide five different types of ammunition. South Korea's divisional artillery consists of weapons of only two calibers.

South Korea has produced copies of vintage US weapons—the M101 105-mm and M114 155-mm howitzers—since the mid-1970s. The South recently introduced a multiple rocket launcher of domestic design and is ready to begin production of a new 155-mm howitzer that is a modification of the US M198.

The North makes all of its own artillery and has been producing copies of towed Soviet and Chinese weapons since the 1960s. It also manufactures a simplified version of the Soviet 122-mm MRL. In the mid-1970s, the North began mass production of self-propelled guns using domestically designed or modified tracked chassis. A new long-range gun—apparently of domestic design—appeared in small numbers in 1978.

Mortars. Heavy mortars often are classed as artillery although the range of fire is far less than that of guns and howitzers. The inclusion of mortars has little effect on the artillery equation (see table 2). The North has one and a half times as many heavy mortars as South Korea. North Korea's mortars have greater destructive power because of their larger and heavier shells. The South's heavy mortars are more mobile and have a higher rate of fire.

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Factors Favoring the South

The South has several advantages that could cut into North Korea's lead in artillery. South Korea has better ammunition, its guns are more accurate, and its doctrine for weapons employment provides a more flexible system for generating firepower.

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Ammunition. The South has a distinct advantage in types of artillery ammunition available. It has a wide range of nonnuclear ammunition and fuses.

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Accuracy and Elevation. As a general rule the South's weapons probably are more accurate than those of the North. Although short in range, the now obsolescent

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howitzers the United States used in Vietnam proved more accurate than Soviet-designed weapons used by the enemy. South Korean copies of the 105- and 155-mm howitzers have characteristics similar to those old US versions.

Weapons with barrels that can be elevated to high angles are advantageous for mountainous terrain. The elevation characteristics of the standard howitzer for both sides are nearly equal and the North has only a slight numerical edge—2,508 to 2,384 in these weapons. The rest of North Korea's weapons, however, are low-trajectory guns and rocket launchers, which would not be as effective as howitzers in some of the more mountainous areas of Korea.

Doctrine and Tactics. In general, both sides apply the tactics of the country where most of their weapons were designed—the USSR for the North and the United States for the South. For generating immediate combat power, South Korea depends on massing fire from many widely separated elements firing at high rates on the same target.

North Korea—for the most part—follows the less sophisticated tactic of massing a large number of weapons opposite the target to achieve the necessary firepower. The South's system allows for greater flexibility in reacting to changing combat situations. The shock and suppression effects from both methods are significant.

Both sides use the full range of target acquisition systems—visual observation, sound and flash ranging, and radar. But ground and air observers are the most effective. They can see the results of artillery fire and call for corrections in distance and direction to achieve the necessary suppression or destruction of the targets. Both North and South Korea use forward observers on the ground, but only the South trains regularly with air observers.

The North's tactic of massing large numbers of artillery presents lucrative targets for air and artillery strikes.

Defensive Advantage. In the event of a North Korean attack, the South's forces would have the advantage of fighting in their own territory on familiar terrain. Because of the unique military situation in Korea, other advantages normally assumed for the defender may not apply to the artillery equation. Both sides man hardened sites with overhead cover near the DMZ. Because of its range advantage, the North should be able to keep some of its artillery in protected positions for some time before moving it forward to more vulnerable firing sites.

Both sides would have to move artillery from positions farther back to support the attacking and defending forces in the areas where high-intensity combat is likely. To achieve the large numerical advantages specified in their doctrine, the North Koreans must move more weapons than the South.

The South plans to fire more rounds per gun and howitzer in defense than we believe North Korea would expend from similar weapons in an offense. In the opening barrages, however, North Korea's rocket launchers are capable of delivering more ordnance than the South's weapons. Over the long term, the North's edge in numbers of weapons, explosives delivery capability, and range might offset the capability to fire more rounds per gun.

Artillery in an Attack Scenario

Neither side would commit all of its artillery in either an offensive or defensive role along the forward lines during a conflict. For a more practical comparison, we devised a scenario in which we measured the capabilities of the artillery that each side would most likely use during the initial stages of combat. The scenario postulates an all-out attack in which North Korea would bring artillery forward, mass its ground forces, and launch assaults across the DMZ. We made no attempt to assign the weapons by sector or invasion corridor because that would presuppose we can determine the North's attack plans with some accuracy.

In this scenario, we postulated that the number of weapons used by the North would come from a force that includes the artillery from 24 infantry divisions and brigades, plus selected artillery units from corps and national-level assets that might support the attacking maneuver elements.[6] For the South, we included the defending weapons available from the 12 divisions within artillery range of the forward-edge-of-battle-area, and the corps-level artillery in all of South Korea's forward corps.

[6] See Defense Intelligence Agency publication DDB-2600-1142-82 (Secret NF NC), March 1982, *North Korean Pre-H-Hour Attack Scenario Study*. (U)

Table 3
Artillery in a Postulated Attack Scenario

	North	South	Ratio
Number of weapons	4,230	1,642	2.6 to 1, North
Cannon	2,880	1,624	1.8 to 1, North
MRLs	1,350	18	75 to 1, North
Explosives delivery capabilities *(kg)*	526,122	66,082	8 to 1, North
Weapons with ranges			
Over 18,000 m	1,611	42	38 to 1, North
14,000 to 18,000 m	711	784	1.1 to 1, South
Under 14,000 m	1,908	816	2.3 to 1, North

By examining the capabilities of artillery under these postulated conditions our results are markedly similar to those found when comparing the total inventories of guns, howitzers, and rocket launchers (see table 3). South Korea's artillery force remains outnumbered, outranged, and well behind in the capability to deliver ordnance as measured by salvo weight in this static comparison. Although the North does not have enough artillery to mass overwhelming numbers of weapons all along the front, its edge in numbers should enable it to concentrate large numbers of weapons in ratios greatly favoring the attacker in selected zones of assault.

Even if the South fired at three times the rate of North Korea's weapons, the potential for delivering explosives over a short period of time would favor the North substantially because of the large amounts of ordnance that can be fired by the MRLs. One BM-11 can deliver nearly 40 times as much shell weight as a 105-mm howitzer in a single barrage, and more than 13 times as much as a 155. Resupply problems and the extended reload times for MRLs, however, could reduce this advantage significantly for the North over time.

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The most important factor favoring the North in this scenario appears to be range. Almost 40 percent of the North's weapons outrange all but 2 percent of South Korea's guns and rockets.

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Appendix A

The Impact of Airpower on the Artillery Equation

South Korea is heavily dependent on its Air Force to provide additional firepower to compensate for its disadvantages in artillery. As in other countries trained in Western-oriented doctrine and tactics, the South relies heavily on close air support for its ground forces. North Korea does not use its airpower in the same way or to the same extent,

When the capability for delivering bombs by aircraft is computed as salvo weight for each air force and added to the tonnage figures for the artillery inventories, North Korea's advantage of over 8 to 1 drops to 1.6 to 1. This gross measure includes the standard bomb loads for all tactical fighters and bombers in both air forces that could be dropped at one time in a single mission.

Table 4 illustrates the total capability of both sides to deliver explosives. A more useful measure would require knowledge of the numbers of aircraft that each side plans to commit to the air-land battle. In the South this would depend on the overall combat situation,

Our gross comparison of salvo weight shows that the North's artillery has the theoretical capacity to deliver nearly as many explosives as the South's Air Force and that South Korea's air delivery capability exceeds that of the North. North Korea's MRLs are capable of delivering 75 percent as many explosives at one time as the entire South Korean Air Force, and probably just as accurately.

Table 4
Salvo Weight for Artillery and Bombs

Metric tons

	North	South
Total artillery	726	86
Fighters and bombers	642	788
Total	**1,368**	**874**

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Strengths and Weaknesses

South Korea's Air Force has better aircraft than the North with greater and more accurate ordnance delivery capabilities and longer loiter time over target. The South also has an integrated system for close air support for the ground forces, which the North lacks. The South has both airborne and ground-based forward air controllers to request and direct airstrikes in support of any ground unit.

the North has a cumbersome system for air support in which the requesting unit must go through the chain of command up to division or even corps level for approval.

We believe, however, that South Korea's airpower will be strained to meet all of its assigned combat missions. South Korea's Air Force has few precision-guided munitions, an extremely limited all-weather capability, and far fewer forward air controllers than are employed by US forces. During a conflict, the South's Air Force will also have to provide air defense against a numerically superior enemy as well as support to ground forces that are outnumbered and outgunned.

North Korea's Air Force is qualitatively inferior to that of the South, and its support of the ground forces is expected to be limited after preparatory attacks against defensive positions of the South Korean ground forces. North Korea basically has only a clear weather strike capability. Only the 73 IL-28 light bombers have a radar-delivery system, and it is old and inaccurate.

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Table 5
Artillery Weapons in Inventories of Active Forces, North and South Korea

North		South	
Number	Type	Number	Type
5,847 (total)		**2,426 (total)**	
900	122-mm howitzer M-30	1,308	105-mm howitzer M101
360	122-mm howitzer SP M-1977	900	155-mm howitzer M114/A1
144	122-mm field gun D-74	12	155-mm gun M59
132	122-mm gun SP M-1981	12	175-mm gun SP M107
276	130-mm field gun M-46	72	203-mm howitzer M115
72	130-mm gun SP M-1975	104	203-mm howitzer SP M110
60	152-mm howitzer D-1	18	130-mm MRL
432	152-mm gun/howitzer D-20		
816	152-mm gun/howitzer SP M-1974		
96	122-mm field gun/152-mm howitzer (A-19/ML-20)		
180	Unidentified field guns/howitzers		
24	Unidentified large caliber SP M-1978		
582	76-mm field gun ZIS-3		
900	122-mm MRL truck-mounted BM-11		
873	107-mm MRL towed type 63		

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The impact of tactics and doctrine was treated only briefly in this study because we have few details on changes in the North's methods of operation that are likely to take place with the large influx of self-propelled artillery over the last few years. Nor do we attempt to compare important intangibles such as leadership and morale. Also, the South's combat capabilities were tested to a degree in Vietnam 10 years ago, but the North's forces have not seen major action since 1953.

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Table 6
Characteristics of Artillery Weapons

	Maximum Firing Range (*meters*)	Maximum Rate of Fire per Minute	Projectile Weight (*kilograms*)	WEI Score [a]
South				
105-mm howitzer M101	11,500	10	15	.71
155-mm howitzer M114/A1	14,600	4	43	.76
155-mm gun M59	23,500	3	43	.76
175-mm gun SP M107	32,700	1.5	66.7	.87
203-mm howitzer M115	16,800	1.5	90.7	.76
203-mm howitzer SP M110	16,800	1.5	90.7	.78
130-mm MRL	23,000	NA	unknown	.80
North				
76-mm gun Z1S-3	13,290	15	6.2	.61
122-mm howitzer M-30	11,800	6	21.8	.72
122-mm howitzer SP M-1977	15,300	8	21.8	.79
122-mm gun D-74	23,900	5	27.5	.69
122-mm gun SP M-1981	23,900	5	27.5	.71
122-mm gun A-19	19,750	1	25	.66
130-mm gun M-46	27,490	5	33.4	.82
130-mm gun SP M-1975	27,490	5	33.4	.84
152-mm howitzer D-1	12,390	4	40	.71
152-mm gun/howitzer D-20	17,230	4	43:6	.77
152-mm SP M-1974	17,230	4	43.6	.79
152-mm gun/howitzer ML-20	17,320	2	40	.72
Ui SP M-1978	unknown	unknown	unknown	.87
107-mm MRL Type-63	8,300	NA	8.4	.65
122-mm MRL BM-11	20,500	NA	19.25	.80

[a] Most of the weapons effectiveness indexes are those published by the Department of the Army for 1979 because later compilations only include a small number of the old weapons still in active use in Korea. In those cases where scores for new or obsolescent weapons were unavailable, we developed our own values based on published scores for comparable systems.

NA not applicable.

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